Atmospheric corrosion and mechanical property degradation of 2524-T3 aluminum alloy in marine environments

Huiyun Tian, Zhongyu Cui*
School of Materials Science and Engineering, Ocean University of China,
（cuizhongyu@ouc.edu.cn）

Abstract: Due to superior mechanical and corrosion resistance properties, high-strength aluminum alloys have been widely used in the aerospace field. Atmospheric corrosion and mechanical properties degradation of 2524-T3 high-strength aluminum alloy are affected by environmental factors. A close relationship exists between corrosion factors and mechanical properties degradation of the alloy in different atmospheric environments, which is meaningful to predict the service life. In the present work, atmospheric corrosion and mechanical property degradation of 2524-T3 high-strength aluminum alloy in different marine atmospheric environments are investigated. The corrosion evolution and surface topographies are analyzed. The relationship between the localized corrosion parameters and mechanical property degradation sensitivity is discussed.

The corrosion of 2524-T3 high-strength aluminum alloy exposed in the tropical marine atmosphere is the most severe, attributed to the high temperature, high humidity, long TOW, and high Cl^- deposition rates. Corrosion of the groundward surface is much more severe than that on the skyward surface because of the longer presence time of the electrolyte layer on the former. The EIS results are closely related to the corrosion evolution process. The severe atmospheric corrosion leads to degradation of mechanical properties. However, the degradation sensitivity does not increase with the exposure time, which has a great relationship with surface corrosion defects. The degradation sensitivity indexed by elasticity modulus is correlated with D_{max}. The degradation rates indexed by elongation, reduction-in-area, and tensile strength show a close relationship with D'_{ave}. (Fig. 1)

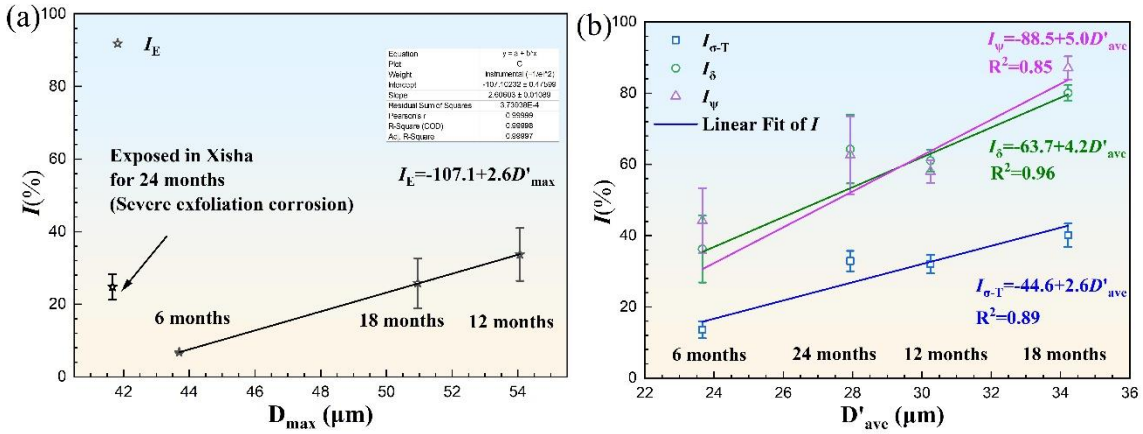

Fig. 1 The D_{max} versus the degradation sensitivity indexed by elasticity modulus (I_E) (a), and the D'_{ave} versus the degradation sensitivity indexed by tensile strength, elongation and reduction-in-area ($I_{σ-T}$, $I_δ$, $I_φ$,) (b).

First Author Profile：Huiyun Tian. Her research interests are marine environment sensitive fracture behavior and mechanism. tianhuiyun@ouc.edu.cn。

Corresponding Author Profile：Zhongyu Cui. His research interests are marine environmental corrosion and protection. cuizhongyu@ouc.edu.cn。

School of Materials Science and Engineering, Ocean University of China, Qingdao 266100, China

Keywords: Aluminum; EIS; SEM; Atmospheric corrosion; Pitting corrosion